

CLASS 501, COMPOSITIONS: CERAMIC**SECTION I - CLASS DEFINITION**

This is the generic class for:

Glass compositions and compositions for making glass, i.e., glass batch compositions, devitrified glass-ceramic compositions and processes for producing such compositions. These compositions may be regarded as thermoplastic compositions.

Refractory compositions comprising primarily earthy, inorganic materials, and/or elemental carbon.

Fired clay containing compositions in the nature of porcelain, earthenware, and similar materials. These compositions may be regarded as thermosetting compositions.

See the Glossary for the definition of the term "ceramic".

SECTION II - LINES WITH OTHER CLASSES AND WITHIN THIS CLASS

Optional ingredients. Disclosures reciting an optional ingredient, such as a statement that a composition includes a range of concentration of the ingredient, including zero percent as the lower end of the range (i.e., containing or comprising 0 - X percent by weight of that ingredient) are classified in a more generic subclass and cross-referenced to an indented subclass which provides for the presence of that ingredient. As an example, a refractory composition which comprises 0 - 10 percent of silicon carbide might be classified as an original in subclass 87 and cross-referenced in subclass 88.

Mol percent and weight percent. When in a disclosure otherwise classifiable in subclasses 54, 55, 73, 121, or 131 recites the concentration of the material specified in the subclass title is in mol percent rather than weight percent, it may be necessary to calculate the equivalent weight percent to classify the disclosure properly.

1. A COMPOUND, PER SE, IS CLASSIFIED IN A COMPOUND CLASS REGARDLESS OF UTILITY.

See References to Other Classes, below, for compound classes.

2. COMPOSITION OR MATERIAL.

A. The rules for determining Class placement of the Original Reference (OR) for claimed chemical compositions are set forth in the Class Definition of Class 252 in the SECTION LINES WITH OTHER CLASSES AND WITHIN THIS CLASS, subsection COMPOSITION CLASS SUPERIORITY, which includes a hierarchical ORDER OF SUPERIORITY FOR COMPOSITION CLASSES.

It is the general rule of classification to classify a process of preparing a composition along with the composition. In those circumstances where only a process of preparing a composition is claimed and there is no claim to a composition, the claim would be classified identically as if it were a composition claim.

B. Lines With Article Or Product Classes.

1. As a general rule, a product (article) is classified with the class specifically providing for the same or a generic class which can take the same.

2. This class (501) provides for an article or product defined in terms of its compositions.

3. An article or product defined by B, 2 above, combined with significant structure for another class will be classified in the class providing for the structure and crossed to Class 501.

4. Subject matter involving multiple claimed inventions--i.e., claims for both Class 501 and those classes in References to Other Classes below that are related to "Composition or Material," section A or section B--will be classified in said class and crossed to Class 501.

See References to Other Classes for article or product classes.

C. PROCESS AND APPARATUS CLASSES

See References to Other Classes, below for process and apparatus classes.

D. SPECIAL CLASSES

See References to Other Classes, below for special classes.

SECTION III - REFERENCES TO OTHER CLASSES

SEE OR SEARCH CLASS:

- 13, Electric Furnaces, subclass 35 for furnace linings. (see Lines With Other Classes, "Composition or Material," section B, above)
- 23, Chemistry: Physical Processes, subclass 230 for physical processes pertaining to ceramic material. (Process class)
- 29, Metal Working, appropriate subclasses for a process of making articles having ceramic material. (Process class)
- 30, Cutlery, subclass 345 for structured cutlery articles defined in part in terms of the materials of its makeup. (see Lines With Other Classes, "Composition or Material," section B, above)
- 34, Drying and Gas or Vapor Contact With Solids, for process and apparatus for drying ceramic material. (Process and apparatus class)
- 52, Static Structures (e.g., Buildings), appropriate subclasses for structures of that class made of ceramic material. (see Lines With Other Classes, "Composition or Material," section B, above)
- 55, Gas Separation, appropriate subclasses for apparatus having ceramic filtering material, especially subclasses 522+; particularly subclass 523 for specific media material, ceramic or sintered. (see Lines With Other Classes, "Composition or Material," section B, above)
- 65, Glass Manufacturing, appropriate subclasses for glass working or treating. See the class definition of Class 65 for the line between Classes 65 and 501, especially the Glossary therein for the definitions of glass working and glass treating, subclasses 2+ for such process of making fibers or filaments; subclasses 19+ for processes employing slag; subclasses 21+ for bead making; subclass 22 for preforming; subclass 33 for devitrifying or vitrifying crystalline glass; subclasses 36+ for fusion bonding of glass to a preformed part, subclasses 60.1+ for a process involving glass working or treating, as well as coating; and subclasses 134+ for processes of purifying or homogenizing molten glass. (Process class)
- 71, Chemistry: Fertilizers, appropriate subclasses for fertilizers containing ceramic material. (see Lines With Other Classes, "Composition or Material," section B, above)
- 71, Chemistry: Fertilizers, appropriate subclasses for process of using ceramic materials in fertilizers. (Process class)
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 228+ for consolidated metal powders which may contain a ceramic material in which the metal particles form a continuous phase, but the ceramic particles do not form a continuous phase. (Special Class)
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 201+ for pyrometallurgy process involving sintering a metal and nonmetal. (Process class)
- 106, Compositions: Coating or Plastic, appropriate subclasses for nonceramic coating or plastic compositions, especially subclasses 74+ for alkali metal silicate containing compositions; subclasses 85+ for inorganic settable compositions; particularly subclasses 100+ for Portland cement making; subclasses 109+ for making cementitious materials from gypsum; subclass 312 for opacifiers intended for inclusion in enamel compositions; and subclass 313 for fluxes intended to be used in ceramic compositions. (Process/apparatus class)
- 110, Furnaces, subclass 323 for refractory type baffle or heat retainer structure of a furnace and subclasses 338+ for brick element. (apparatus class)
- 117, Single-Crystal, Oriented-Crystal, and Epitaxy Growth Processes; Non-Coating Apparatus Therefor, for processes and non-coating apparatus for growing therein-defined single-crystal of all types of materials, including ceramic. (Process/apparatus class)
- 126, Stoves and Furnaces, appropriate subclasses for stoves and furnaces which may contain a ceramic element, especially subclass 400 for fireless cookers which are heat accumulators; subclasses 204+ for body warmers; and subclass 273.5 for ovens. (apparatus class)
- 200, Electricity: Circuit Makers and Breakers, subclasses 262+ for electrical contacts composed of named material. (see Lines With Other Classes, "Composition or Material," section B, above)
- 201, Distillation: Processes, Thermolytic, subclass 18 for process of using apparatus of the class of particular composition. (Process/apparatus class)
- 204, Chemistry: Electrical and Wave Energy, subclasses 280+ for electrolytic electrodes. (see Lines With Other Classes, "Composition or Material," section B, above)

- 204, Chemistry: Electrical and Wave Energy, appropriate subclasses, especially subclasses 157.15+ for processes of preparing a specific compound utilizing a wave energy process. (Compound class)
- 210, Liquid Purification or Separation, appropriate subclasses for process and apparatus using ceramic material in a liquid separation operation. (Process/apparatus class)
- 216, Etching a Substrate: Processes, for methods of chemically etching ceramic materials. (Process class)
- 219, Electric Heating, subclasses 73+ for a slag composition being used as an environment for electric heating. (Process/apparatus class)
- 241, Solid Material Comminution or Disintegration, appropriate subclasses for process or apparatus for comminuting materials. See section 2 of the Class 241 definition for the class line. (Process/apparatus class)
- 249, Static Molds, subclass 134 for molds having named material classifiable, per se, in this class (501). (see Lines With Other Classes, "Composition or Material," section B, above)
- 252, Compositions, subclass 62 for sound or heat insulators defined by their composition which is other than ceramic. (see Lines With Other Classes, "Composition or Material," section B, above)
- 257, Active Solid-State Devices (e.g., Transistors, Solid-State Diodes), appropriate subclasses for those devices which contain ceramic material, including subclass 700, 701+, especially 703 and 705 for ceramic housing or package materials. (see Lines With Other Classes, "Composition or Material," section B, above)
- 261, Gas and Liquid Contact Apparatus, subclasses 94+ and 100+ for porous contact devices in the form of a mass or sheet. (see Lines With Other Classes, "Composition or Material," section B, above)
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, for processes of molding or shaping compositions of matter which include significant molding or shaping operation. The line between this class (501) and Class 264 is as follows: Class 501 takes processes of making compositions within the class definition even though including the step of molding, when such step is claimed broadly. Broad references to extruding, spinning into a setting medium (without naming the medium) or sheeting in a claim to the preparation of a composition of matter, are considered broad molding steps. Also the statement that heat and pressure are used during the molding, whether or not specific temperatures or specific pressures are recited, is not considered sufficient of itself to take a patent claiming a process of preparing a composition out of this class (501). See especially subclasses 239+ for shaping or molding a ceramic article; and digest 39 for processes of treating clay before and after molding. For a detailed discussion of the line between Class 264 and the composition classes, see the definitions of Class 264 and the notes to subclasses 603+ therein. (Process/apparatus class)
- 266, Metallurgical Apparatus, subclass 280 for linings for metallurgical apparatus. (apparatus class)
- 338, Electrical Resistors, appropriate subclasses for electrical resistors having ceramic material. (see Lines With Other Classes, "Composition or Material," section B, above)
- 359, Optics: Systems (Including Communication) and Elements, appropriate subclasses for articles of that class having ceramic materials, especially glass, which may be classified, per se, in this class (501). (see Lines With Other Classes, "Composition or Material," section B, above)
- 361, Electricity: Electrical Systems and Devices, subclass 320 and 321.1+ for fixed capacitors having ceramic and glass materials. (see Lines With Other Classes, "Composition or Material," section B, above)
- 376, Induced Nuclear Reactions: Processes, Systems, and Elements, subclasses 409+ for nuclear fuels with significant structural features which may be made of a named ceramic composition. However, ceramic compositions, per se, which may be useful to construct nuclear fuel elements are classified in this class (501). (see Lines With Other Classes, "Composition or Material," section B, above)
- 404, Road Structure, Process, or Apparatus, subclasses 17+ for preparation of pavements; and subclasses 72+ for processes of preparing road structures which may involve a Class 501 composition. (see Lines With Other Classes, "Composition or Material," section B, above)
- 404, Road Structure, Process, or Apparatus, subclasses 75+ for processes of treating earth or a roadway in situ including the application of a ceramic material thereto, and see the note to Class 501 in the main class definition of Class 404. (Process/apparatus class)

- 405, Hydraulic and Earth Engineering, subclasses 263+ for processes and apparatus for chemical treatment of earth formations in situ to condition the formation or to prevent undesired movement thereof. (Process/apparatus class)
- 422, Chemical Apparatus and Process Disinfecting, Deodorizing, Preserving, or Sterilizing, subclasses 245.1+ for non-coating crystallization apparatus not including means for chemical reaction not provided for elsewhere and subclasses 129+ for non-coating crystallization apparatus including means for chemical reaction and not provided for elsewhere. (Process/apparatus class)
- 423, Chemistry of Inorganic Compounds, appropriate subclasses for inorganic compound or non-metallic element disclosed or claimed having a utility in a Class 501 composition. (Compound class)
- 425, Plastic Article or Earthenware Shaping or Treating: Apparatus, appropriate subclasses for apparatus for shaping or treating ceramic compositions other than glass. (apparatus class)
- 427, Coating Processes, appropriate subclasses for processes of coating with ceramic compositions. (Process class)
- 428, Stock Material or Miscellaneous Articles, subclasses 304.4+ for stock material containing one cellular or porous component which may comprise a ceramic composition; subclass 426 for nonstructural laminated stock material which includes a glass composition; subclasses 446+ for nonstructural laminated stock material which includes a composition including silicon or a compound of silicon; and 539.5, for stock material containing free metal particles and ceramic particles wherein there is a metal continuous phase interengaged with a nonmetal continuous phase as a result, e.g., of a sintering operation. (see Lines With Other Classes, "Composition or Material," section B, above)
- 428, Stock Material or Miscellaneous Articles, subclass 38 for glass containing wire mesh reinforcement; subclasses 426+ for plural layer stock material in which at least one layer contains a glass; and subclass 539.5 for sintered compacts comprising both metal or alloy particles and ceramic particles in which there is present a metal continuous phase interengaged with a ceramic continuous phase. (Special Class)
- 429, Chemistry: Electric Current Producing Apparatus, Product, and Process, subclasses 247+ for battery separators which may comprise a ceramic material. (Process/apparatus class)
- 429, Chemistry: Electrical Current Producing Apparatus, Product, and Process, appropriate subclasses for chemical current producing structures which may comprise a ceramic component and for processes of producing electric current by chemical means utilizing or producing a ceramic composition. (see Lines With Other Classes, "Composition or Material," section B, above)
- 432, Heating, subclasses 1+ for a residual process of heating or calcining an object or material which is clearly distinct from the composition and for processes and apparatus for the firing of ceramic materials not involving the shaping thereof. (Process/apparatus class)
- 433, Dentistry, appropriate subclasses for ceramic dental articles. (see Lines With Other Classes, "Composition or Material," section B, above)
- 442, Fabric (Woven, Knitted, or Nonwoven Textile or Cloth, etc.), appropriate subclasses for glass fiber fabric. (Special Class)
- 451, Abrading, subclasses 28+ for an abrading process using ceramic materials. (Process class)
- 505, Superconductor Technology: Apparatus, Material, Process, subclasses 100+ for high temperature (T_c 30 K) superconducting materials, per se, or subclasses 300+ for processes of producing same. (see Lines With Other Classes, "Composition or Material," section B, above)
- 520, Synthetic Resins or Natural Rubbers, the series for synthetic resin, per se, even though such resin is disclosed or claimed as having a Class 501 utility. A resin, per se, is one containing no intentional additive to perfect it for a Class 501 purpose. See the remainder of the class (260) for an organic compound having a Class 501 utility not provided for elsewhere. This portion of Class 260 is being reclassified into the 530 to 570 series of classes. See the search notes thereunder. (Compound class)
- 526, Synthetic Resins or Natural Rubbers, for polymers of unsaturated monomers only, per se, even if disclosed or claimed as having a Class 501 utility. (Compound class)
- 588, Hazardous or Toxic Waste Destruction or Containment, appropriate subclasses for the containment and storage of hazardous or toxic waste which may involve vitrification. (Process/apparatus class)

SECTION IV - GLOSSARY

The meaning to be given to the various “art” terms appearing in this class, but which have not been included in the Glossary below, is the same as that generally accepted or in common usage. However, certain terms employed in this class, which are included below, have been assigned definitions tailored to meet the needs of this class and therefore those may be more restricted or less limited or even altogether different from those in common usage.

ALKALINE EARTH METAL

Alkaline Earth Metal is considered to be generic to calcium, strontium, and barium. In this class (501), magnesium is not considered to be an alkaline earth metal and compositions containing magnesium compounds are generally provided for apart from those of alkaline earth metals.

CERAMIC

Inorganic compositions which are heat treated to harden them during their manufacture or subsequent use by firing, calcining, sintering, or fusion of at least a portion of the inorganic material, including glass compositions, fired clay compositions which form, e.g., porcelain or brick, and refractories. Such materials typically, but not necessarily, include earthy materials, such as metal (and especially mixed metal) silicates.

CLAY

The naturally occurring earthy materials (or artificial compositions having generally equivalent chemical and physical properties) containing a substantial proportion (30 percent or more) of colloidal particles (under .002mm.), and which becomes plastic when mixed with water and which plastic material is capable of being hardened when fired and containing a major proportion of hydrated aluminum silicates which are derived by the weathering or decomposition of granite or other feldspathic rock.

- (1) Note. Many natural materials are considered to be clays, e.g., kaolin, fire clays, ball clays, china clays, bentonite, fuller's earth, bauxite, montmorillonite, halloysite, and argillaceous earths.

- (2) Note. Typical clay containing ceramic compositions or articles are, e.g., common or face brick, structural blocks, porcelain bricks, pottery, china, terra cotta, tile, sewer pipe, and some coating and filling compositions.

EARTHENWARE, PORCELAIN

These terms designate fine grained or fully vitreous, high fired white or translucent ceramic materials, frequently, but not always containing clay or similar plastic components. Among many terms used to designate somewhat similar materials are stoneware, earthenware, porcelain, pottery, china, whiteware, tile, crockery, sanitaryware, terra cotta, bisque, rakuware, and slip cast ware. They are not intended for use in the high temperature or corrosive environments where materials referred to as refractories are typically employed.

FIBER

A slender, elongated structure of relatively small, uniform diameter having a much greater length, which may have a relatively short finite length or an indeterminate length.

FRIT

A glass composition in a powdered or granulated state prepared by fusing the glass and quenching it in a cold liquid. Frits form an important part of the batches used in compounding glazes and enamels.

GLASS

Inorganic compositions which solidify from the molten state without crystallizing, to have that molecular disorder characteristic of the glass state, which have no definite melting point, are incapable in the solid state of permanent deformation, which fracture when subjected to deformation tension and include as components at least one “glass former” material.

- (1) Note. Typical glass formers are, e.g., oxides of silicon, beryllium, boron, germanium, phosphorus, vanadium, lead, tin, zinc, zirconium, and titanium, as well as such nonoxide compounds as GeS, metal fluorides, or iodides, and some metallic selenides, tellurides, arsenides, and phosphides. These compositions may also include other oxides devoid of glass form-

ing tendencies, e.g., oxides of alkali metals, alkaline earth metals, and magnesium.

- (2) Note. Many ceramic compositions containing primarily slag, the by product of metal refining and smelting are considered to be glasses.
- (3) Note. Neither transparency to light nor the absence of color are necessary for a composition to be considered as a glass for the purpose of this class.
- (4) Note. Water glass, Plexiglas, and isinglass are not considered to be glass for the purpose of classification in Class 501.
- (5) Note. Organic, noncrystalline solid materials, such as synthetic resins which may be referred to as organic glasses, e.g., Plexiglas, are not considered to be glass for the purpose of classification in Class 501.

PORE FORMING (POROUS, MULTICELLULAR)

These terms embrace porous compositions, compositions intended to be further treated to make them porous or processes for effecting the porosity or multicellularity. A positive step for causing porosity must be recited and porosity which is the result of including a naturally porous material in the composition is not classified in the pore-forming subclasses of this class (501).

RARE EARTH ELEMENT

As used in this class (501), this term encompasses those elements having atomic numbers from 57 through 71 inclusive, and 89+. Thus, the following elements are herein treated as rare earth elements: lanthanum, cerium, praeosodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutecium, actinium, thorium, protoactinium, uranium, neptunium, and plutonium.

REFRACTORY

Compositions which are specifically formulated to be resistant to abrasion, corrosion and physical or chemical disintegration when subjected to high temperatures, chemically corrosive environments and/or rapid temperature changes.

- (1) Note. Refractory materials are typically used to produce furnace and kiln linings, fire brick, kiln furniture and saggars, and pyroceramic cones.

- (2) Note. Among naturally occurring materials widely used in making refractory products are, e.g., magnesite, dolomite, and chrome-magnesite.

VITREOUS, VITRIFY

Vitrification is the progressive fusion of the particles in a ceramic body. As vitrification progresses, the proportion of glassy bond increases and the apparent porosity of the substance decreases. Glass in a massive form (rather than in a frit or powder) and porcelain are considered to be fully vitrified.

SUBCLASSES

1 CERAMIC COMPOSITIONS:

This subclass is indented under the class definition. Compositions other than Portland cement or cementitious material prepared from gypsum, having an inorganic base, which are heat treated to effect hardening or fusion followed by hardening when cooled either during their manufacture or during subsequent use by firing, calcining, sintering, or fusion of at least part of the inorganic material, and processes not elsewhere classified for their production.

- (1) Note. Included herein are glass compositions, refractory materials employed in furnace and crucible walls, kiln-fired clay products, and similar materials.
- (2) Note. Ceramic dielectrics, such as those containing barium titanate, are classified in this or indented subclasses unless they are disclosed or claimed as being piezoelectric, in which case, they are classified in Class 252, Compositions, subclass 62.9, or in Class 310, Electric Generator or Motor Structure, subclasses 8+ if claimed as having a particular shape which is particular to the piezoelectric property. If the ceramic dielectric is claimed or disclosed broadly as having piezoelectric properties, the ceramic dielectric is not classified here either as an original or a cross reference,

but is classified in appropriate class provided for the piezoelectric composition, e.g., Class 252 or Class 310 as noted above.

SEE OR SEARCH CLASS:

- 52, Static Structures (e.g., Buildings), appropriate subclasses for cast monoliths or ceramic members characterized by significant structural configuration.
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 228+ for consolidated compositions of metals or alloys including those containing ceramic or refractory or other nonmetallic components, e.g. cermets.
- 106, Compositions: Coating or Plastic, subclasses 739+ for the making of Portland cement; subclasses 772+ for the preparation of cementitious materials from gypsum; and subclass 313 for fluxes which are to be used in the production of ceramic compositions.
- 252, Compositions, subclasses 301.4+ for inorganic luminescent compositions.
- 264, Plastic and Nonmetallic Article Shaping or Treating: Processes, appropriate subclass for processes, within the class definition, including a significant molding operation or a significant treatment of a molded article. In particular, see subclass 30, 31+, 43+, 125, and 603+ therein. For a detailed discussion of the line between Class 264 and the composition classes, see the definitions of Class 264 and the notes to subclasses 56+ therein.

2 Devitrified glass ceramics:

This subclass is indented under subclass 1. Compositions containing a crystalline phase embedded in a glassy (amorphous) phase, which crystalline phase is produced by cooling a molten glass composition to a temperature which causes a portion only of the composition to crystallize while the remainder of the composition (the matrix) solidifies in the amorphous or glassy state.

- (1) Note. The crystalline phase is typically uniformly dispersed throughout the glassy phase and it must constitute at least 50 percent by weight of the total composition.
- (2) Note. The subclasses indented hereunder are established on the basis of the nature of the crystalline phase. Patents placed as originals in the indented subclasses may be cross-referenced when appropriate in other subclasses of this class on the basis of the nature of the glassy matrix phase.
- (3) Note. Documents classified as originals in this and indented subclasses are cross-referenced on the basis of the chemical nature of the glass composition disclosed into subclasses 40, 41+, and/or 53+, as appropriate.
- (4) Note. Documents classified as originals in this and indented subclass which are directed to optical glass compositions are cross-referenced to subclasses 900+.

3 Halogen containing crystalline phase (e.g., fluormica, etc.):

This subclass is indented under subclass 2. Compositions in which the crystalline phase includes a halogen atom.

- (1) Note. The crystalline phase may comprise, e.g., fluormica, etc.

4 Silica containing crystalline phase (e.g., stuffed quartz, cristobalite, etc.):

This subclass is indented under subclass 2. Subject matter wherein the crystalline phase comprises silica.

- (1) Note. The crystalline phase may comprise, e.g., the so-called stuffed quartz, cristobalite (a crystalline form of SiO₂), etc.

5 Binary, ternary, quaternary, etc., metal silicate crystalline phase (e.g., mullite, diopside,

- sphene, plagioclase, slagcerams free of alumina, etc.):**
This subclass is indented under subclass 2. Subject matter wherein the crystalline phase comprises silicates of two or more metals.
- (1) Note. The crystalline phase may comprise, e.g., diopside (CaMgSiO_6), sphene (CaTiSiO_5), plagioclase (triclinic feldspar), a slagceram free of Al_2O_3 , etc.
- 6 Alkali metal aluminosilicate crystalline phase:**
This subclass is indented under subclass 5. Compositions in which the silicate comprises an alkali metal aluminosilicate.
- 7 Lithium aluminosilicate (e.g., spodumene, eucryptite, petalite, etc.):**
This subclass is indented under subclass 6. Compositions in which the alkali metal aluminosilicate comprises a lithium aluminosilicate.
- (1) Note. The aluminosilicate may be, e.g., spodumene ($(\text{Li,Na})_2\text{Al}_2\text{Si}_4\text{O}_{12}$), eucryptite (LiAlSiO_4), petalite ($\text{Li}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 8\text{SiO}_2$), etc.
- 8 Divalent metal oxide aluminosilicate crystalline phase (e.g., anorthite, slagcerams, etc.):**
This subclass is indented under subclass 5. Compositions in which the silicate comprises a divalent metal oxide aluminosilicate.
- (1) Note. The silicate may be an aluminosilicate of an alkaline earth metal, magnesium, zinc, or zirconium, e.g., anorthite ($\text{CaAl}_2\text{Si}_2\text{O}_7$), a slagceram, etc.
- 9 Magnesium aluminosilicate (e.g., cordierite, etc.):**
This subclass is indented under subclass 8. Compositions in which the silicate comprises a magnesium aluminosilicate.
- (1) Note. The silicate may be, e.g., cordierite ($\text{Mg}_2\text{Al}_4\text{Si}_5\text{O}_{20}$), etc.
- 10 Nonsilica and nonsilicate crystalline phase (e.g., spinel, barium titanate, etc.):**
This subclass is indented under subclass 2. Compositions in which the crystalline phase does not include silica or a silicate.
- (1) Note. The crystalline phase may comprise, e.g., spinel (MgAl_2O_4), gahnite (ZnAl_2O_4), franklinite (Fe, Zn, Mn Fe_2O_4), chromite (FeCr_2O_4), barium titanate (BaTiO_3), etc.
- 11 Glass compositions, compositions containing glass other than those wherein glass is a bonding agent, or glass batch forming compositions:**
This subclass is indented under subclass 1. Compositions which comprise a glass or compositions intended to be heat treated so as to form a glass.
- (1) Note. To be classified herein, the chemical nature of the glass composition must be unspecified.
- (2) Note. A typical disclosure appropriate for this subclass might be, e.g., a product by process claim, etc.
- (3) Note. Compositions containing both glass and nonglass materials in which the glass serves merely as a binder for particles of the other material are not included herein, but are classified on some other basis.
- (4) Note. This and indented subclasses include compositions of enamels and glazes, etc., which are glasses.
- (5) Note. Documents classified as originals in this and indented subclasses which disclose optical glass compositions are cross-referenced in subclasses 900+.
- SEE OR SEARCH CLASS:**
- 65, Glass Manufacturing, subclasses 134+ for processes of purifying or homogenizing molten glass.
- 220, Receptacles, subclasses 2.1+ for envelopes for electric lamps, electronic tubes and similar devices which

are made of glass. Where no more is claimed than an envelope of a specific composition of glass the patent is classified in this class (501). Where the composition is claimed and also some structure of the envelope, the patent is classified in Class 220.

12 **Made by gel route:**

This subclass is indented under subclass 11. Compositions which have been prepared by a method other than melting including at least one step in which the glass forming ingredients are in a gel or sol state, and glass making processes involving such a step.

- (1) Note. Documents classified as originals in this subclass are cross-referenced on the basis of the chemical nature of the glass composition disclosed into subclasses 40, 41+, and/or 53+, as appropriate.
- (2) Note. Documents classified as originals in this subclass which disclose optical glass compositions are cross-referenced in subclasses 900+.

SEE OR SEARCH CLASS:

- 65, Glass Manufacturing, subclasses 134+ for processes of homogenizing or purifying molten glass.
- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes of Making, Stabilizing, Breaking, or Inhibiting, subclasses 98+ for colloid systems of continuous or semicontinuous solid phase with discontinuous liquid phase (gels, pastes, flocs, coagulates) or agents for such systems or making or stabilizing such systems or agents, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.

13 **Radiation color change responsive:**

This subclass is indented under subclass 11. Compositions which are capable of reversibly changing color or darkening in response to the presence of electromagnetic radiation and which if darkened thereby fade when the electromagnetic radiation is removed.

- (1) Note. Documents classified as originals in this subclass are cross-referenced on the basis of the chemical nature of the glass composition disclosed into subclasses 40, 41+, and/or 53+, as appropriate.

- (2) Note. Documents classified as originals in this subclass which disclose optical glass compositions are cross-referenced in subclasses 900+.

SEE OR SEARCH CLASS:

- 252, Compositions, subclass 300 for optical filter compositions and subclass 600 for other radiation sensitive compositions.
- 430, Radiation Imagery Chemistry: Process, Composition, or Product Thereof, subclass 13 for imaged products containing an image within a transparent base.

14 **Enamels, glazes, or fusion seals (e.g., raw, fritted, or calcined ingredients):**

This subclass is indented under subclass 11. Compositions disclosed as vitreous enamels, or glazes, or similar compositions which are intended for use as seals between glass and/or metal components of various devices.

- (1) Note. The compositions in this and indented subclasses have typically been cross-referenced below on the basis of their specific ingredient content, e.g., to subclasses 21+ for frit compositions, subclass 40 for nonoxide glasses, subclasses 41+ for nonsilica and nonsilicate containing oxide glasses, and subclasses 53+ for SiO₂ containing glasses.
- (2) Note. Documents classified as originals in this and indented subclasses which disclose optical glass compositions are cross-referenced in subclasses 900+.

SEE OR SEARCH CLASS:

- 106, Compositions: Coating or Plastic, subclass 312 for opacifiers for enamels, per se.
- 427, Coating Processes, for processes of enameling with vitreous enamel compositions.

- 523, Synthetic Resins or Natural Rubbers, appropriate subclasses, particularly subclass 170 for a composition containing a synthetic resin or Natural Rubbers and having utility as an enamel composition for glass or for a medium or binder in the preparation of glass enamel or to processes of preparing said composition.
- 15 Fusion seals (frit plus material other than glass):**
This subclass is indented under subclass 14. Compositions disclosed for use as seals between other ceramic glass, and/or metal components of various devices, and containing a frit plus some other ingredient which is not a glass.
- (1) Note. These compositions are sometimes disclosed as glass solders.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
17+, for glass compositions containing a frit plus a material other than glass which are not disclosed as seal glasses.
- 16 Plural diverse frits:**
This subclass is indented under subclass 14. Compositions comprising two or more distinct frits having different compositions.
- 17 Frit plus material other than glass (e.g., color, opacifier, mill additions, etc.):**
This subclass is indented under subclass 14. Compositions which comprise a frit plus at least one other material which is not a glass.
- (1) Note. The other material may be, e.g., an opacifying agent, a coloring agent, or any material added during the milling or other comminuting operation to enhance that process or to improve the properties of the product of that process.
- 18 Titanium zirconium compound as other material:**
This subclass is indented under subclass 17. Compositions which contain a compound of titanium or zirconium as the other material.
- 19 Free metal as other material:**
This subclass is indented under subclass 17. Subject matter in which the other material is a free metal.
- (1) Note. The free metal may be, e.g., in the form of copper flakes, aluminum powder, etc.
- (2) Note. See the class definition of this class (501) for the general lines between this class and other composition classes relative to cermets, powder metallurgy compacts and similar materials.
- 20 With vehicle or suspending agent (i.e., slip):**
This subclass is indented under subclass 17. Compositions which contain a liquid vehicle or a suspending agent.
- (1) Note. Such a composition containing a liquid vehicle is frequently referred to as a slip.
- 21 Chemically specified frit compositions:**
This subclass is indented under subclass 14. Compositions which are in a powdered or comminuted form, defined in terms of their chemical content.
- 22 Lead containing:**
This subclass is indented under subclass 21. Compositions which include lead or a lead compound.
- 23 And titanium or zirconium:**
This subclass is indented under subclass 22. Compositions which additionally include titanium or zirconium or a compound of either of them.
- 24 Phosphorus containing:**
This subclass is indented under subclass 21. Compositions which contain phosphorus or a compound of phosphorus.
- 25 Halogen containing:**
This subclass is indented under subclass 21. Compositions which include a halogen atom, either as a free element or in the form of a halogen compound.

26 Zinc containing:

This subclass is indented under subclass 21. Compositions which include zinc or a zinc compound.

27 Glass batch forming compositions (i.e., glass batch compositions):

This subclass is indented under subclass 11. Compositions which are intended to be heated sufficiently for its ingredients to fuse into a glass.

(1) Note. The ingredients of the batch may include a previously prepared glass, such as scrap glass or cullet.

(2) Note. These compositions are sometimes referred to as glass furnace charges.

28 Slag containing:

This subclass is indented under subclass 27. Compositions which comprise slag, the non-metallic by product from various metallurgical processes.

29 Pellet or agglomerate containing:

This subclass is indented under subclass 27. Compositions which include at least one ingredient in the form of shaped particles, e.g., pellets, granules, briquettes, nodules, etc.

30 Halogen containing:

This subclass is indented under subclass 27. Compositions which include a free halogen or a halogen compound.

31 Uncombined silica containing (e.g., sand):

This subclass is indented under subclass 27. Compositions which contain uncombined silica as an ingredient of the batch.

(1) Note. The uncombined silica is typically disclosed to be sand.

32 Glass and material other than glass (e.g., crystal glass, opal glass, etc.):

This subclass is indented under subclass 11. Compositions which contain a glass and at least one ingredient which is not a glass, wherein the nonglass ingredient is not dissolved in the glass.

(1) Note. This subclass includes such materials as, e.g., two phase glasses, opal glass, crystal glass, etc.

(2) Note. Documents classified as originals in this subclass are cross-referenced on the basis of the chemical nature of the glass composition disclosed into subclasses 40, 41+, and/or 53+ as appropriate.

(3) Note. Documents classified as originals in this subclass which disclose optical glass compositions are cross-referenced in subclasses 900+.

33 Beads:

This subclass is indented under subclass 11. Subject matter wherein the glass is present in the form of discrete lumps or small shaped self-supporting pieces larger than what may be considered as powder or compositions specifically intended to be made into beads.

(1) Note. Documents classified as originals in this and indented subclasses are cross-referenced on the basis of the chemical nature of the glass composition disclosed into subclasses 40, 41+, and/or 53+, as appropriate.

(2) Note. Documents classified as originals in this and indented subclasses which disclose optical glass compositions are cross-referenced in subclasses 900+.

SEE OR SEARCH CLASS:

65, Glass Manufacturing, subclass 21 for processes of making glass beads and balls, including hollow ones, by a process of glass working classified in Class 65.

34 Reflective:

This subclass is indented under subclass 33. Beads or glass compositions for forming beads which are intended for use as reflective elements.

SEE OR SEARCH CLASS:

106, Compositions: Coating or Plastic, appropriate subclasses for coating or plastic compositions containing such beads.

35

Fibers:

This subclass is indented under subclass 11. Compositions which are in the form of fibers or which are disclosed for use in manufacturing fibers.

- (1) Note. Documents classified as originals in this and indented subclasses are cross-referenced on the basis of the chemical nature of the glass composition disclosed into subclasses 40, 41+, and/or 53+, as appropriate.
- (2) Note. Documents classified as originals in this and indented subclasses which disclose optical glass compositions are cross-referenced in subclasses 900+.

SEE OR SEARCH CLASS:

428, Stock Material or Miscellaneous Articles, appropriate subclasses for glass fiber batts used for insulation, filters, and other applications.

36

Mineral fibers (e.g., slag wool, rock wool, mineral wool, etc.):

This subclass is indented under subclass 35. Compositions which are disclosed as slag wool, rock wool, or mineral wool, etc.

SEE OR SEARCH THIS CLASS, SUBCLASS:

28, for glass batch forming compositions comprising slag.

37

Optical fibers:

This subclass is indented under subclass 35. Fibers which are intended to be used as conductors of light in fiber optics applications.

- (1) Note. Such fibers may have the so-called core and clad construction, and where the core and cladding components are defined in terms of their composition without recitation of specific optics use enhancing structural features, they are classified herein.

SEE OR SEARCH CLASS:

385, Optical Waveguides, appropriate subclasses for fiber optics reciting significant optical structure.

38

Titanium or zirconium containing:

This subclass is indented under subclass 35. Fibers comprising titanium, zirconium, or a compound of one of these elements.

39

Pore-forming:

This subclass is indented under subclass 11. Compositions which are porous, or which are to be further treated to produce multicellular products or processes for producing porous glass products.

- (1) Note. To be classified herein, a process or composition must involve a specific step to form the pores. Where the porosity is due merely to the presence of a naturally porous ingredient it is classified on some other basis.
- (2) Note. Documents classified as originals in this and indented subclasses are cross-referenced on the basis of the chemical nature of the glass composition disclosed into subclasses 40, 41+, and/or 53+, as appropriate.
- (3) Note. Documents classified as originals in this and indented subclasses which disclose optical glass compositions are cross-referenced in subclasses 900+.

SEE OR SEARCH THIS CLASS, SUBCLASS:

80+, for pore-forming of ceramics other than glass compositions.

SEE OR SEARCH CLASS:

- 51, Abrasive Tool Making Process, Material, or Composition, subclass 296 for pore-forming abrasive tool compositions.
- 65, Glass Manufacturing, especially subclasses 20 through 22 and 30 for making porous glass by processes which include glass working operations classified in that class (65).
- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes

of Making, Stabilizing, Breaking, or Inhibiting, subclasses 10+ for foam colloid systems or agents for such systems or making or stabilizing such systems or agents, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.

- 40 Nonoxide glasses (e.g., fluoride glasses, etc.):**
This subclass is indented under subclass 11. Compositions consisting solely of materials other than oxides.

(1) Note. The glass may comprise, e.g., binary or ternary halides, sulfides, or nitrides of germanium, selenium, or tellurium.

SEE OR SEARCH CLASS:

148, Metal Treatment, subclasses 304+ and 403 for so-called alloy glasses or glassy alloys which contain only metals in an amorphous solid state.

- 41 Nonsilicate oxide glasses:**
This subclass is indented under subclass 11. Compositions which contain oxides of elements other than silicon and which do not contain any silica or silicate.

- 42 Germanium containing:**
This subclass is indented under subclass 41. Compositions containing germanium or a germanium compound.

- 43 Halogen containing:**
This subclass is indented under subclass 41. Compositions containing a halogen or halogen compound.

- 44 Fluorine and phosphorus containing:**
This subclass is indented under subclass 43. Compositions in which the halogen is fluorine and the composition additionally contains phosphorus or a phosphorus compound.

- 45 Phosphorus containing:**
This subclass is indented under subclass 41. Compositions containing phosphorus or a compound of phosphorus.

SEE OR SEARCH THIS CLASS, SUBCLASS:

44, for similar compositions containing fluorine in addition to the phosphorus.

- 46 And titanium, zirconium, vanadium, tungsten, or molybdenum:**

This subclass is indented under subclass 45. Compositions additionally containing titanium, zirconium, vanadium, tungsten, or molybdenum, or a compound of any of these elements.

- 47 And boron:**

This subclass is indented under subclass 45. Compositions additionally containing boron or a boron compound.

- 48 And aluminum or beryllium:**

This subclass is indented under subclass 45. Compositions additionally containing aluminum or beryllium or a compound of either of them.

- 49 Boron containing:**

This subclass is indented under subclass 41. Compositions containing boron or a boron compound.

- 50 And yttrium or rare earth (i.e., elements with atomic numbers 39, 57-71, or 89+):**

This subclass is indented under subclass 49. Compositions additionally containing yttrium or a rare earth in elemental or compound form.

(1) Note. Included herein are compositions including yttrium, lanthanide, actinide, or transactinide elements or compounds of any such elements. Specifically included are yttrium, lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytterbium, lutecium, actinium, thorium, protoactinium, uranium, neptunium, and plutonium.

- 51 And zirconium, titanium, tantalum, or niobium:**

This subclass is indented under subclass 50. Compositions additionally containing zirconium, titanium, tantalum, or niobium, or a compound of any of these elements.

- 52 And aluminum or beryllium:**
This subclass is indented under subclass 49. Compositions additionally containing aluminum or beryllium, or a compound of either of these elements.
- 53 Silica containing:**
This subclass is indented under subclass 11. Compositions containing silica (SiO_2).
- (1) Note. The silica is typically present in combination with metallic oxides, i.e., in the silicate, mixed silicate, or polysilicate form.
- (2) Note. This subclass takes claims to silica containing glass compositions which do not specify the percent by weight content of the silica in the total composition. Where such content is specified, classification takes place into subclasses 54, 55+, or 73+.
- (3) Note. In the subclasses indented hereunder, a disclosure of the weight percent of SiO_2 in the composition which is in the form of a range extending on both sides of the 40 percent and/or 90 percent limit recited in the titles of subclasses 54, 55, and 73, is classified or cross-referenced in such a way that an official copy appears in appropriate subclasses on both sides of that limit. For example, a disclosure of 28-42 percent SiO_2 content is classified in subclasses 55+ and cross-referenced in subclasses 73+.
- 54 More than 90 percent by weight silica:**
This subclass is indented under subclass 53. Subject matter wherein the silica comprises over 90 percent by weight of the total composition.
- 55 40 percent-90 percent by weight silica:**
This subclass is indented under subclass 53. Compositions wherein the silica content is at least 40 percent but not more than 90 percent by weight of the total composition.
- 56 And halogen or nitrogen:**
This subclass is indented under subclass 55. Compositions additionally containing a halogen or nitrogen or a compound of either.
- 57 Fluorine:**
This subclass is indented under subclass 56. Compositions containing fluorine or a fluorine compound.
- 58 And boron:**
This subclass is indented under subclass 57. Compositions additionally containing boron or a boron compound.
- 59 And aluminum:**
This subclass is indented under subclass 58. Compositions additionally containing aluminum or an aluminum compound.
- 60 And lead:**
This subclass is indented under subclass 55. Compositions additionally containing lead or a lead compound.
- 61 And boron:**
This subclass is indented under subclass 60. Compositions additionally containing boron or a boron compound.
- 62 And aluminum:**
This subclass is indented under subclass 60. Compositions additionally containing aluminum or an aluminum compound.
- 63 And phosphorus, niobium, or tantalum:**
This subclass is indented under subclass 55. Compositions additionally containing phosphorus, niobium, or tantalum or a compound of any of these elements.
- 64 And yttrium or rare earth (i.e., elements with atomic numbers 39 or 57-71):**
This subclass is indented under subclass 55. Compositions additionally containing yttrium or a rare earth in elemental or compound form.
- (1) Note. Specifically included herein are compositions containing yttrium, lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, terbium, dysprosium, holmium, erbium, thulium, ytter-

bium, or lutecium in elemental or compound form.

65 And boron:

This subclass is indented under subclass 55. Compositions additionally containing boron or a boron compound.

66 And aluminum:

This subclass is indented under subclass 65. Compositions additionally containing aluminum or an aluminum compound.

67 And zinc or zirconium:

This subclass is indented under subclass 66. Compositions additionally containing zinc or zirconium or a compound of either of these elements.

68 And aluminum or iron compound:

This subclass is indented under subclass 55. Compositions additionally containing compounds of aluminum or of iron.

69 And divalent metal oxide (e.g., oxides of zinc, cadmium, beryllium, alkaline earth metal, magnesium, etc.):

This subclass is indented under subclass 68. Compositions additionally containing an oxide of a divalent metal.

(1) Note. The divalent metal may be, e.g., zinc, cadmium, beryllium, an alkaline earth metal, magnesium, etc.

70 Calcium oxide containing:

This subclass is indented under subclass 69. Compositions in which the divalent metal oxide is calcium oxide.

(1) Note. This subclass takes, for example, many glass compositions which are identified as common sheet or container glass, such as the well known soda-lime glasses.

71 And chromium, nickel, or cobalt:

This subclass is indented under subclass 70. Subject matter wherein the composition further includes chromium, nickel, or cobalt or a compound of one of those elements.

(1) Note. The compositions classified herein are typically colored glasses or glasses which selectively absorb light.

SEE OR SEARCH THIS CLASS, SUBCLASS:

70, for similar compositions containing oxides of metals other than chromium, nickel, or cobalt.

72 And divalent metal oxide (e.g., oxides of zinc, cadmium, beryllium, alkaline earth metal, magnesium, etc.):

This subclass is indented under subclass 55. Compositions containing an oxide of a divalent metal.

(1) Note. The divalent metal (may be, e.g., zinc, cadmium, beryllium, an alkaline earth metal or magnesium).

73 Less than 40 percent by weight silica:

This subclass is indented under subclass 53. Compositions containing silica in an amount equal to less than 40 percent by weight of the total composition.

74 And lead:

This subclass is indented under subclass 73. Compositions which contain lead or a lead compound.

75 And boron:

This subclass is indented under subclass 74. Compositions additionally containing boron or a boron compound.

76 And zinc:

This subclass is indented under subclass 75. Compositions additionally containing zinc or a zinc compound.

77 And boron:

This subclass is indented under subclass 73. Compositions which contain boron or a boron compound.

78 And rare earth (i.e., elements with atomic number 39 or 57-71):

This subclass is indented under subclass 77. Compositions additionally containing a rare earth element or a compound of any rare earth element.

- (1) Note. For the purpose of this classification, rare earth elements are those having atomic numbers 39 or 57-71.

79 And zinc:

This subclass is indented under subclass 77. Compositions additionally containing zinc or a zinc compound.

80 Pore-forming:

This subclass is indented under subclass 1. Compositions other than glass compositions which are multicellular, or which are to be further treated to produce multicellular products, or processes for producing such products.

- (1) Note. A positive pore-forming step is required for classifying a claim herein and porosity due to the presence of a naturally porous substance is not sufficient for inclusion herein.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 39, for pore-forming involving glass compositions.

SEE OR SEARCH CLASS:

- 51, Abrasive Tool Making Process, Material, or Composition, subclass 296 for porous abrading tool and process for making such.
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclasses 228+ for consolidated metal and ceramic powder materials, including, e.g., cermets, wherein there is a continuous metal phase and processes of making same.
- 106, Compositions: Coating or Plastic, subclasses 601+ for pore-forming and porous compositions comprising an alkali metal silicate; subclasses 672+ for pore-forming involving settable hydraulic cements; and subclass 122 for pore-forming involving other coating or plastic compositions.
- 516, Colloid Systems and Wetting Agents; Subcombinations Thereof; Processes

of Making, Stabilizing, Breaking, or Inhibiting, subclasses 10+ for foam colloid systems or agents for such systems or making or stabilizing such systems or agents, when generically claimed or when there is no hierarchically superior provision in the USPC for the specifically claimed art.

- 520, Synthetic Resins for Natural Rubbers, in particular Class 521, subclasses 50+ for porous product and pore-forming processes.

81 By use of organic combustible material:

This subclass is indented under subclass 80. Subject matter wherein the porosity results from combustion of an organic combustible material, e.g., hair, tar, pitch, etc.

82 Of resin or vegetable origin material:

This subclass is indented under subclass 81. Subject matter in which the organic combustible material is either a natural or synthetic resin or is a material of vegetable origin.

- (1) Note. The combustible material may be, e.g., shellac, a polystyrene resin, coal, an alginate, etc.

83 Of cellulosic material:

This subclass is indented under subclass 82. Subject matter in which the combustible material contains cellulose or a reaction product thereof.

- (1) Note. Such material may be, e.g., cork, wood, sawdust, nutshells, bark, straw, chaff, collodion, etc.

84 By gas blowing, foaming agent, or in situ reactive gas generation:

This subclass is indented under subclass 80. Processes which include blowing a gaseous material through a molten ceramic composition, or which employ a foaming agent, or which employ materials which interact to yield a gas, which gas lends porosity to the composition and compositions to be used in such processes.

85 By volatilizing or heat expansion of water or other noncombustible material:

This subclass is indented under subclass 80. Processes wherein porosity results from volatilization or expansion caused by heating of water or other noncombustible material contained in the composition, and compositions to be used in such processes.

86 Synthetic precious stones (e.g., single crystals, etc.):

This subclass is indented under subclass 1. Compositions which are artificial precious stones, which are usually formed by the solidification of a melted composition containing ingredients giving the desired appearance, and processes for preparing such products except those forming single-crystals.

SEE OR SEARCH CLASS:

- 23, Chemistry: Physical Processes, subclasses 295+ for physical processes of crystallizing inorganic chemical compounds or non-metal elements and where a single-crystal is not intended. The products, per se, are generally classified as chemical compounds. The process of de-twinning is classified in Class 117. Methods preventing decomposition of crystals by enclosing the crystals in an environment rich in the decomposition product (e.g., ammonium salt surrounded by ammonia gas) are classified with the crystal product.
- 63, Jewelry, subclass 32 for jewelry in which the invention lies in the gem.
- 117, Single-Crystal, Oriented-Crystal, and Epitaxy Growth Processes; Non-Coating Apparatus Therefor, for processes and non-coating apparatus for growing therein-defined single-crystal of all types of materials, including inorganic or organic.
- 252, Compositions, subclass 301.17 for laser compositions.
- 423, Chemistry of Inorganic Compounds, subclass 446 for synthetic diamonds and their manufacture.

87 Carbide or oxycarbide containing:

This subclass is indented under subclass 1. Compositions which include at least one compound which is a binary compound of a metal directly bonded to carbon (i.e., a carbide) or is a ternary compound of a metal, carbon, and oxygen of the type: $2(\text{ZrO}_2)\text{C}$ or ZrO_2C (i.e., an oxycarbide or carboxide).

SEE OR SEARCH CLASS:

- 51, Abrasive Tool Making Process, Material, or Composition, for a composition specialized for use as an abrasive. Patents containing claims to the abrasive function as well as claims to a function or use specifically provided for in Class 501 (e.g. refractory) are placed in this class (501) as originals and cross-referenced to Class 51, especially subclasses 307+ for abrasive compositions which may include carbides.
- 423, Chemistry of Inorganic Compounds, subclasses 439+ for carbide compound, per se.

88 Silicon carbide:

This subclass is indented under subclass 87. Compositions which contain a silicon carbide, e.g., SiC .

89 And aluminum compound:

This subclass is indented under subclass 88. Subject matter additionally comprising a compound of aluminum.

- (1) Note. The aluminum compound may be, for example, Al_2O_3 or clay.

90 And carbonaceous material:

This subclass is indented under subclass 88. Subject matter additionally comprising a material containing free carbon.

- (1) Note. The free carbon containing material may be, for example, graphite or tar.

91 And different carbide:

This subclass is indented under subclass 88. Compositions which contain a carbide of an element other than silicon in addition to the silicon carbide.

92 And boride, silicide, nitride, or oxynitride:

This subclass is indented under subclass 88. Compositions which contain a silicide, boride, nitride, or oxynitride, in addition to silicon carbide.

- (1) Note. A silicide is a binary compound of a metal or other more positive element with silicon, e.g., Mg_2Si .
- (2) Note. A boride is a binary compound of boron with a more positive element, e.g., Mg_3B_2 , Si_3B_4 .
- (3) Note. A nitride is a binary compound of nitrogen with a metal, e.g., Mg_3N_2 .
- (4) Note. An oxynitride is a ternary compound of nitrogen, oxygen and a more positive element of the form Si_2ON_2 .

93 Plural carbides (i.e., carbides of plural metals) containing:

This subclass is indented under subclass 87. Compositions which include at least two different carbide compounds.

94 Refractory:

This subclass is indented under subclass 1. Subject matter directed to refractory compositions and processes for their preparation.

- (1) Note. See the Glossary in the class definition of this class for the definition of the term "refractory".
- (2) Note. Among the art terms used to describe materials classified herein are: refractories, heat resistant materials, or linings, furnace linings, firebrick, pyroceramic cones, kiln brick, kiln linings, kiln furniture, and saggers.

SEE OR SEARCH THIS CLASS, SUBCLASS:

- 87+, for ceramic refractory compositions which contain a carbide or oxycarbide.

SEE OR SEARCH CLASS:

- 51, Abrasive Tool Making Process, Material, or Composition, subclass 307 for the use of inorganic material which may contain a ceramic composition being used as an abrasive material within the class definition.
- 52, Static Structures (e.g., Buildings), subclass 596 for building blocks with significant structural features which may comprise a refractory composition.
- 75, Specialized Metallurgical Processes, Compositions for Use Therein, Consolidated Metal Powder Compositions, and Loose Metal Particulate Mixtures, subclass 301 for furnace linings which contain chemicals having a refining effect on molten metal.
- 373, Electric Furnaces, subclasses 71+ and 137 for electric furnace linings, per se, defined structurally.
- 451, Abrading, subclass 28 for the use of an abrading material which may contain a ceramic composition being used in an abrading process under the class definition.
- 508, Solid Antifriction Devices, Materials Therefor, Lubricant and Separant Compositions for Moving Solid Surfaces, and Miscellaneous Mineral Oil Compositions, for lubricant compositions which may contain a refractory abrasive ingredient.
- 510, Cleaning Compositions for Solid Surfaces, Auxiliary Compositions Therefor, or Processes of Preparing the Compositions, appropriate subclasses for cleaning compositions comprising an abrasive or scouring component which may include a refractory material.

95.1 Fiber or fiber containing:

This subclass is indented under subclass 94. Compositions which are in the form of a fiber or filament.

- (1) Note. This subclass does not encompass methods of making fibers, per se. Such processes are generally classified in the appropriate material class.

SEE OR SEARCH CLASS:

520, Synthetic Resins or Natural Rubbers, for synthetic resin fibers.

95.2 Composites (continuous matrix with dispersed fiber phase):

This subclass is indented under subclass 95.1. Compositions which are characterized by having fibers as a dispersed phase in a continuous matrix.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

95.1, for processes for preparing refractory fiber compositions, per se.

SEE OR SEARCH CLASS:

427, Coating Processes, for methods of coating and impregnation of fibers under the class definition.

520, through 528, Synthetic Resins or Natural Rubbers, for synthetic resin fibers.

95.3 Whisker containing:

This subclass is indented under subclass 95.2. Compositions characterized as having whiskers in a continuous matrix.

- (1) Note. Whiskers are short, bristly hairlike fibers characterized by high tensile strength and single crystal structure.

SEE OR SEARCH THIS CLASS, SUB-CLASS:

95.1, for making refractory whisker compositions, per se.

96.1 Boride, silicide, nitride, oxynitride, carbonitride, or oxycarbonitride containing:

This subclass is indented under subclass 94. Compositions comprising at least one compound which is a boride, silicide, nitride, oxynitride, carbonitride, or oxycarbonitride.

- (1) Note. A silicide is a binary compound of a metal or other more positive element with silicon (e.g., Mg_2Si , etc.).
- (2) Note. A boride is a binary compound of boron with a more positive element (e.g., Mg_3B_2 , Si_3B_4 , etc.).

- (3) Note. A nitride is a binary compound of nitrogen with a metal (e.g., Mg_3N_2 , etc.).

- (4) Note. An oxynitride is a ternary or quaternary inorganic compound of nitrogen, oxygen, and a more positive element of the type $G_AO_BN_C$ or $G_AJ_BO_CN_D$ wherein G and J are the more positive elements, and A, B, C, and D are greater than zero.

- (5) Note. A carbonitride is a ternary inorganic compound of nitrogen, carbon, and a more positive element of the type $G_AC_BN_C$ wherein G is the more positive element, and A, B, and C are greater than zero.

- (6) Note. An oxycarbonitride is a quaternary inorganic compound of oxygen, carbon, nitrogen, and a more positive element of the type $G_AO_BC_CN_D$, wherein G is the more positive element, and A, B, C, and D are greater than zero.

96.2 From organometallic precursor:

This subclass is indented under subclass 96.1. Subject matter produced from an organometallic precursor.

- (1) Note. The claims need not specify production from an organometallic precursor. The requirement of this subclass may be satisfied by reference to the specification.

96.3 Boride or silicide containing:

This subclass is indented under subclass 96.1. Compositions in which a component is a boride, a silicide, or mixture thereof.

96.4 Boron nitride containing:

This subclass is indented under subclass 96.1. Compositions in which a component is boron nitride (BN).

96.5 Silicon oxynitride, silicon carbonitride, or silicon oxycarbonitride containing (i.e., $Si_AO_BN_C$, $Si_AC_BN_C$, or $Si_AO_BC_CN_D$):

This subclass is indented under subclass 96.1. Compositions in which a component is silicon oxynitride ($Si_AO_BN_C$), silicon carbonitride

- ($\text{Si}_A\text{C}_B\text{N}_C$), or silicon oxycarbonitride ($\text{Si}_A\text{O}_B\text{C}_C\text{N}_D$).
- (1) Note. A, B, C, D must be greater than zero.
- 97.1 Silicon nitride containing (Si_3N_4):**
This subclass is indented under subclass 96.1. Compositions in which a component is silicon nitride (Si_3N_4).
- 97.2 With trivalent metal compound (e.g., yttrium, rare earth, or aluminum compound, etc.):**
This subclass is indented under subclass 97.1. Compositions additionally containing a trivalent metal compound.
- (1) Note. Si_3N_4 plus an aluminum compound is not the same as SiAlON.
- (2) Note. This subclass provides for the combination of Si_3N_4 , per se, with an additional compound of a trivalent metal. Silicon aluminum oxynitride, a single compound, does not meet this criterion.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
98.1, for silicon aluminum oxynitride.
- 97.3 With alkaline earth metal compound:**
This subclass is indented under subclass 97.2. Compositions additionally containing an alkaline earth metal compound.
- 97.4 Composites (continuous matrix with dispersed phase):**
This subclass is indented under subclass 97.1. Compositions characterized by having a dispersed phase in a continuous matrix, wherein silicon nitride may be either the dispersed phase or the continuous matrix, or may be in either the dispersed phase or in the continuous matrix.
- 98.1 Silicon aluminum oxynitride containing (i.e., SiAlON compounds):**
This subclass is indented under subclass 96.1. Compositions in which silicon aluminum oxynitride (SiAlON) is found.
- 98.2 With rare earth or alkaline earth metal compound:**
This subclass is indented under subclass 98.1. Compositions in which a rare earth or alkaline earth metal compound is found.
- 98.3 Composites (continuous matrix with dispersed phase):**
This subclass is indented under subclass 98.1. Subject matter characterized by having a dispersed phase in a continuous matrix, wherein SiAlON may be either the dispersed phase or the continuous matrix, or may be in either the dispersed phase or in the continuous matrix.
- 98.4 Aluminum nitride containing (AlN):**
This subclass is indented under subclass 96.1. Subject matter in which aluminum nitride (AlN) is found.
- 98.5 With alkaline earth metal compound:**
This subclass is indented under subclass 98.4. Subject matter additionally containing an alkaline earth metal compound.
- 98.6 Composites (continuous matrix with dispersed phase):**
This subclass is indented under subclass 98.4. Subject matter characterized by having a dispersed phase in a continuous matrix, where aluminum nitride may be either the dispersed phase or the continuous matrix, or may be in either the dispersed phase or in the continuous matrix.
- 99 Elemental carbon containing:**
This subclass is indented under subclass 94. Subject matter wherein the refractory composition comprises elemental carbon.
- (1) Note. The carbon source may be in the form of, e.g., tar, pitch, coke, or graphite.
- 100 And aluminum compound (e.g., clay, aluminum oxide, etc.):**
This subclass is indented under subclass 99. Subject matter wherein the refractory composition additionally includes a compound of aluminum.
- (1) Note. The aluminum compound may comprise, e.g., clay or Al_2O_3 .

- 101 And alkaline earth metal or magnesium compound (e.g., dolomite, magnesium oxide, etc.):**
This subclass is indented under subclass 99. Subject matter wherein the refractory composition additionally includes a compound of an alkaline earth metal or of magnesium.
- (1) Note. The alkaline earth metal compound may be, e.g., dolomite ($\text{CaMg}(\text{CO}_3)_2$) or lime (CaO) and the magnesium compound may be, e.g., magnesia (MgO).
- 102 Zirconium compound containing:**
This subclass is indented under subclass 94. Subject matter wherein the composition includes a compound of zirconium.
- 103 Zirconium oxide:**
This subclass is indented under subclass 102. Subject matter comprising an oxide of zirconium.
- (1) Note. The zirconium oxide is frequently disclosed to be ZrO_2 .
- 104 And alkaline earth metal or magnesium compound:**
This subclass is indented under subclass 103. Subject matter further including a compound of an alkaline earth metal or magnesium.
- 105 And aluminum compound (e.g., clay, aluminum oxide, etc.):**
This subclass is indented under subclass 103. Subject matter further including a compound of aluminum.
- (1) Note. The aluminum compound may be, e.g., clay or Al_2O_3 .
- 106 Zirconium silicate:**
This subclass is indented under subclass 102. Subject matter comprising a silicate of zirconium.
- (1) Note. The zirconium silicate may be disclosed to be, e.g., zircon (ZrSiO_4).
- 107 And aluminum compound (e.g., clay, aluminum oxide, etc.):**
This subclass is indented under subclass 106. Subject matter further including a compound of aluminum.
- (1) Note. The aluminum compound may be, e.g., clay, or alumina (Al_2O_3).
- 108 Magnesium compound containing:**
This subclass is indented under subclass 94. Subject matter comprising a compound of magnesium.
- 109 With organic material in starting mixture:**
This subclass is indented under subclass 108. Subject matter additionally comprising an organic compound or other organic substance in the starting mixture.
- (1) Note. The organic substance must no longer be present as such in the final product to be classifiable herein.
- 110 And iron or chromium compound:**
This subclass is indented under subclass 109. Subject matter additionally comprising a compound of iron or chromium.
- 111 And phosphorus compound:**
This subclass is indented under subclass 108. Subject matter additionally comprising a compound of phosphorus.
- 112 And iron compound:**
This subclass is indented under subclass 108. Subject matter additionally comprising a compound of iron.
- 113 Dolomite containing:**
This subclass is indented under subclass 112. Subject matter wherein the magnesium compound comprises dolomite ($\text{CaMg}(\text{CO}_3)_2$).
- 114 And chromium compound:**
This subclass is indented under subclass 112. Subject matter additionally comprising a compound of chromium.

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| <p>115 Fused cast or fused material containing:
This subclass is indented under subclass 114. Subject matter wherein the composition is in solid block form or a portion of the composition is comprised of previously fused material.</p> <p>116 Chemical binder containing:
This subclass is indented under subclass 114. Subject matter wherein the ceramic particles are bonded to each other at least in part by a chemical substance other than that of the ceramic particles themselves.</p> <p>(1) Note. The chemical binder may be, e.g., sodium silicate.</p> <p>117 And chromium compound:
This subclass is indented under subclass 108. Subject matter additionally comprising a compound of chromium.</p> <p>118 And aluminum compound:
This subclass is indented under subclass 108. Subject matter additionally comprising a compound of aluminum.</p> <p>119 Aluminum compound other than clay:
This subclass is indented under subclass 118. Subject matter wherein the aluminum compound is other than clay.</p> <p>(1) Note. The aluminum compound may be, for example, aluminum oxide, or chloride.</p> <p>120 Spinel or other aluminate:
This subclass is indented under subclass 119. Subject matter wherein the aluminum compound is spinel (MgAl_2O_4) or another aluminate.</p> <p>121 Less than 90 percent by weight magnesium compound:
This subclass is indented under subclass 108. Subject matter wherein the magnesium compound comprises less than 90 percent by weight of the total composition.</p> <p>122 And silicon compound:
This subclass is indented under subclass 108. Subject matter additionally comprising a compound of silicon.</p> | <p>123 Alkaline earth metal compound containing:
This subclass is indented under subclass 94. Subject matter wherein an alkaline earth metal compound is included in the composition or is employed in the process of preparing the composition.</p> <p>124 Hydraulic cement containing:
This subclass is indented under subclass 123. Subject matter including a hydraulic cement.</p> <p>(1) Note. The hydraulic cement may be, e.g., of the Portland cement or calcium aluminate cement type.</p> <p>125 And aluminum compound:
This subclass is indented under subclass 123. Subject matter further comprising a compound of aluminum.</p> <p>(1) Note. The aluminum compound may be, e.g., aluminum chloride.</p> <p>126 Trivalent metal compound (e.g., iron oxide, chromium oxide, trivalent rare earth oxide, etc.) containing:
This subclass is indented under subclass 94. Subject matter containing a compound of a trivalent metal.</p> <p>(1) Note. The trivalent compound, may be, for example, an oxide of trivalent iron, trivalent chromium, or a trivalent rare earth.</p> <p>127 Aluminum compound (e.g., clay, aluminum oxide, etc.):
This subclass is indented under subclass 126. Subject matter wherein the trivalent metal is aluminum.</p> <p>128 And silicon compound other than clay:
This subclass is indented under subclass 127. Subject matter additionally containing a compound of silicon other than clay.</p> <p>129 And silica-clay mixtures:
This subclass is indented under subclass 128. Subject matter wherein the silicon compound is silica and the aluminum compound is clay.</p> |
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- 130 And clay containing:**
This subclass is indented under subclass 128. Subject matter comprising clay.
- 131 Less than 40 percent by weight clay:**
This subclass is indented under subclass 130. Subject matter wherein the clay is present in a concentration greater than zero percent and less than 40 percent by weight of the total composition.
- 132 Chromium compound containing:**
This subclass is indented under subclass 126. Subject matter comprising a compound of chromium.
- 133 Silica containing:**
This subclass is indented under subclass 94. Subject matter wherein the refractory composition comprises silica.
- 134 Titanate, zirconate, stannate, niobate, or tantalate or oxide of titanium, zirconium, tin, niobium, or tantalum containing (e.g., dielectrics, etc.):**
This subclass is indented under subclass 1. Subject matter comprising a titanate, zirconate, stannate, niobate, or tantalate compound or an oxide of titanium, zirconium, tin, niobium, or tantalum.
- (1) Note. Many of the compositions in this and indented subclasses are disclosed as being useful as dielectric materials.
- 135 Alkaline earth or magnesium containing:**
This subclass is indented under subclass 134. Compositions containing a compound of an alkaline earth or magnesium.
- 136 Titanate containing:**
This subclass is indented under subclass 135. Compositions which include a titanate compound, i.e., a salt of titanate acid (H_2TiO_3).
- (1) Note. Compositions which contain an oxide of titanium but no titanate are classified in other subclasses.
- 137 Barium titanate:**
This subclass is indented under subclass 136. Compositions in which the titanate compound is a barium titanate.
- 138 And divalent metal oxide other than alkaline earth oxide or magnesium oxide:**
This subclass is indented under subclass 137. Subject matter additionally containing an oxide of a divalent metal other than an alkaline earth metal or magnesium.
- (1) Note. The Alkaline earth includes calcium, strontium and barium.
- 139 And trivalent metal oxide:**
This subclass is indented under subclass 137. Subject matter additionally containing an oxide of a trivalent metal.
- 140 Elemental sulfur containing:**
This subclass is indented under subclass 1. Subject matter wherein the ceramic composition includes elemental sulfur, e.g., as a binder.
- (1) Note. Compositions classified herein are typically prepared by cooling a ceramic composition containing molten sulfur.
- 141 Clay containing (e.g., porcelain, earthenware, etc.):**
This subclass is indented under subclass 1. Compositions or methods for their preparation which include a clay ingredient.
- (1) Note. Many of the compositions classified herein are described as constituting porcelain or earthenware.
- SEE OR SEARCH THIS CLASS, SUBCLASS:
127+, for refractory compositions including clay.
- SEE OR SEARCH CLASS:
106, Compositions: Coating or Plastic, subclass 468 and 486+ for fillers, pigments, and aggregates comprising clay.
- 142 And phosphorus (e.g., bone china, etc.):**
This subclass is indented under subclass 141. Subject matter wherein the composition further includes phosphorus or a compound of phosphorus.

- (1) Note. Some of the compositions classified herein are described as constituting bone china.
- 143 And flint or feldspar:**
This subclass is indented under subclass 141. Compositions additionally containing flint or feldspar.
- 144 Kaolin (e.g., ball clay, fire clay, etc.) containing:**
This subclass is indented under subclass 143. Compositions additionally containing kaolin.
- (1) Note. The kaolin may be disclosed as ball clay, fire clay, china clay, porcelain clay, bolus alba, terra alba, white bole, or argilla.
- 145 Clay pretreatment:**
This subclass is indented under subclass 141. Processes for treating clay directed to the enhancement of its properties when subsequently used as a component of a ceramic composition.
- SEE OR SEARCH CLASS:
- 106, Compositions: Coating or Plastic, subclass 468 and 486+ for treatment of clay to enhance its use as an ingredient of a coating or plastic composition, e.g., as a paper filler.
- 502, Catalyst, Solid Sorbent, or Support Therefor: Product or Process of Making, subclasses 60+ for treatment of zeolite or clay, including Gallium analogs, including to prepare, e.g., activated clay and clay catalysts.
- 146 Chemical pretreatment:**
This subclass is indented under subclass 145. Subject matter in which a pretreatment of the clay includes treatment thereof with a treating agent in addition to or other than water, which agent reacts chemically with the clay.
- 147 Using alkaline compound treating agent:**
This subclass is indented under subclass 146. Compositions wherein the treating agent comprises a compound of an alkali forming metal or an amine or ammonium compound.
- (1) Note. The alkali forming metal may be an alkali metal, an alkaline earth metal or magnesium.
- 148 Using organic substance as treating agent:**
This subclass is indented under subclass 146. Subject matter wherein the treating agent is an organic compound or material.
- 149 Water pretreatment:**
This subclass is indented under subclass 145. Subject matter wherein the clay is treated with water which does not contain a chemical treating agent.
- (1) Note. Such treatment may take place at other than ambient temperature and/or pressure.
- 150 Heat treatment:**
This subclass is indented under subclass 145. Subject matter wherein clay is treated at an elevated temperature below that necessary to cause vitrification and in the absence of added water or ingredients which react chemically with the clay.
- 151 Fluorine containing:**
This subclass is indented under subclass 1. Subject matter which includes fluorine or a fluorine compound.
- (1) Note. Included herein are, e.g., polycrystalline fluoride materials, such as fluoaluminate dielectric materials and micaceous ceramics not otherwise classifiable.
- 152 Yttrium, lanthanide, actinide, or transactinide containing (i.e., atomic numbers 39 or 57-71 or 89+):**
This subclass is indented under subclass 1. Subject matter comprising in elemental form or in a compound thereof an element having an atomic number of 39, 57-71, or 89+.
- (1) Note. Included herein are compositions including yttrium, lanthanide, actinide, or transactinide elements or compounds of any such elements. Specially included are yttrium, lanthanum, cerium, praseodymium, neodymium, promethium, samarium, europium, gadolinium, ter-

bium, dysprosium, holmium, erbium, thulium, ytterbium, lutecium, actinium, thorium, protoactinium, uranium, neptunium, and plutonium.

153 Aluminum compound containing:

This subclass is indented under subclass 1. Subject matter comprising aluminum or a compound of aluminum.

154 Silicon compound containing:

This subclass is indented under subclass 1. Subject matter comprising silicon or a compound of silicon.

155 Composed of waste material:

This subclass is indented under subclass 1. Subject matter comprising materials retrieved as residues from other processes or as scraps.

- (1) Note. Slag, red mud and clinker are common terms used in the art which would be suitable for use with a composition or process of this subclass.

SEE OR SEARCH CLASS:

588, Hazardous or Toxic Waste Destruction or Containment, subclasses 252+ for the solidification, vitrification, or cementation of hazardous or toxic waste.

CROSS-REFERENCE ART COLLECTIONS

These collections pertain to optical glasses in subclasses 13, 40, 41+, and 53+.

900 Optical glass (e.g., silent on refractive index and/or abbe number):

Cross-reference copies of original patents in the above enumerated subclasses which disclose optical glass compositions wherein neither the refractive index nor the Abbe number is disclosed.

- (1) Note. Disclosures of optical glass compositions reciting a refractive index or Abbe number are cross-referenced in the indented subclasses 901 through 906.

901 Having R.I. at least 1.8:

This subclass takes cross-references of patents which are originals in subclasses enumerated above disclosing an optical glass composition

or method of making same having a refractive index of at least 1.8.

902 Having abbe number at least 70:

This subclass takes cross-reference of patents which are originals in subclasses enumerated above disclosing an optical glass composition or method of making same having an Abbe number of at least 70.

903 Having refractive index less than 1.8 and abbe number less than 70:

This subclass takes cross-reference copies of patents which are originals in the above enumerated subclasses disclosing an optical glass composition or method of making same having a refractive index of less than 1.8 and an Abbe number of less than 70.

904 Infrared transmitting or absorbing:

This subclass takes cross-references of patents which are originals in subclasses enumerated above disclosing an optical glass composition or method of making same disclosed as having the property of or being specifically formulated to enhance the transmission or absorption of radiation in the infrared portion of the electromagnetic spectrum.

- (1) Note. The infrared portion of the spectrum is considered to include 14,000 - 15,000 A5 or 10^{12} - 10^{14} HZ.

905 Ultraviolet transmitting or absorbing:

This subclass takes cross-references of patents which are originals in subclasses enumerated above disclosing an optical glass composition or method of making same disclosed as having the property of or being specifically formulated to enhance the transmission or absorption of radiation in the ultraviolet portion of the electromagnetic spectrum. The ultraviolet portion of the spectrum is considered to include 4,000 - 40,000 A5 or 10^{15} - 10^{17} HZ.

906 Thorium oxide containing:

Optical glasses which comprise thorium oxide (ThO₂).

END